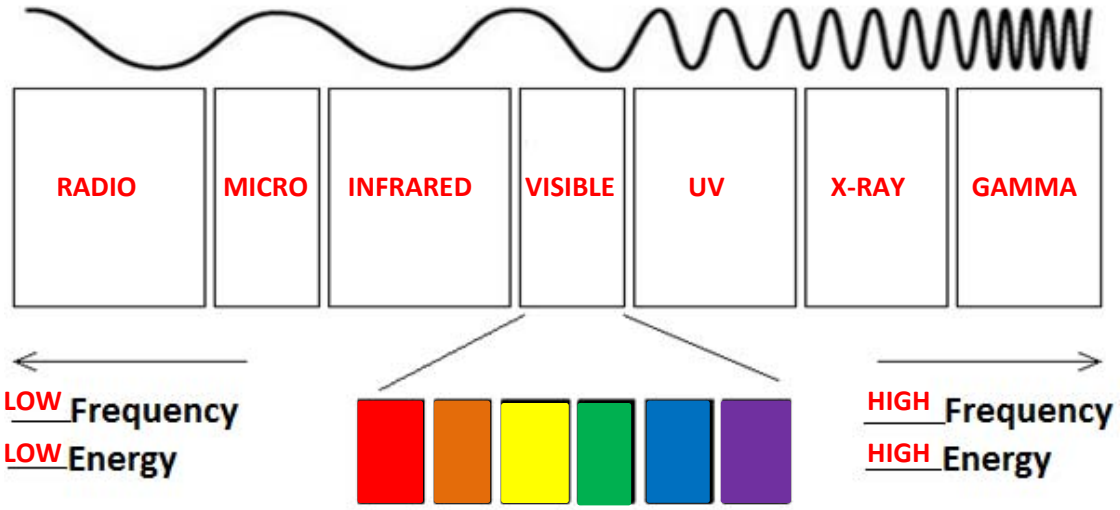
Astronomy – Final Exam Study Guide

Go back through your notes to help you thoroughly answer each question. Questions provide review of main ideas, but other concepts conveyed in labs, videos, and class discussions within each unit are likely to show up on the exam as well.

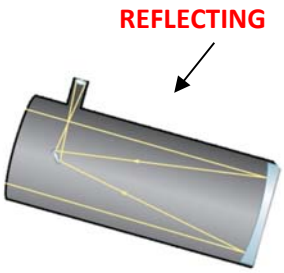
Unit 1 – Light and Optics

- **Electromagnetic Spectrum**
  - **Label the types of electromagnetic radiation in the boxes below. Can you also name a couple uses of each type?**

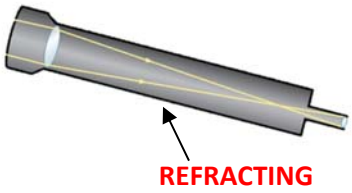


- EMR is organized according to what property? ___WAVELENGTH_____
- What is the relationship between wavelength & frequency?
  - Label "High" or "Low" on the lines next to Frequency on the diagram above
- What is the relationship between wavelength & energy?
  - Label "High" or "Low" on the lines next to Energy on the diagram above
- Use colored pencils to shade in the visible spectrum boxes on the diagram.
  - What **color** of **visible** light has the highest energy? ___VIOLET_____
  - What **color** of **visible** light has the lowest energy? ___RED_____
- Which type of EM radiation has the highest energy? ___GAMMA_____ Lowest? ___RADIO_____
- Which type of EM radiation has the highest frequency? ___GAMMA_____ Lowest? ___RADIO_____

- **Telescopes**
  - What benefits do telescopes provide?
    - MAKE DIM OBJECTS APPEAR BRIGHTER
    - ALLOW US TO SEE VERY DISTANT OBJECTS
    - ALLOW US TO VIEW SPACE IN ALL WAVELENGTHS



  - Differentiate between **refracting** and **reflecting** telescopes.
    - Label the telescope at right that is a refractor
      - What does it use to focus light? GLASS LENSES
    - Label the telescope at right that is a reflector
      - What does it use to focus light? MIRRORS



  - Who was the first person to use a telescope to look at the night sky? GALILEO
    - Which of the two optical telescope designs did he use? REFRACTING
  - Describe a GOOD location for a ground-based telescope:

    A DARK, DRY LOCATION AT HIGH ELEVATION (LESS ATMOSPHERE TO DISTORT LIGHT)

  - Astronomers use both ground-based and space-based telescopes. Use the chart below to organize the pros and cons of each.

Ground-Based	Space-Based
Pros: • EASIER TO ACCESS FOR REPAIRS • CHEAPER OVERALL TO BUILD • CAN BE MADE VERY LARGE	Pros: • NO CONCERNS ABOUT LIGHT POLLUTION OR ATMOSPHERIC INTERFERENCE • CAN BE BUILT TO SEE ALL FORMS OF LIGHT
Cons: • WILL ALWAYS HAVE SOME ATMOPSHERIC DISTORTION • CANNOT VIEW GAMMA, X-RAY, ALL UV OR SOME MICROWAVES • CAN ONLY OPERATE AT NIGHT	Cons: • VERY EXPENSIVE TO BUILD USING SPECIAL MATERIALS 7& LAUNCH • CANNOT BE REPAIRED IF IT MALFUNCTIONS ONCE IN SPACE • HAVE TO BE SMALL TO FIT IN A ROCKET

  - What is the name of NASA's newest space telescope? JAMES WEBB SPACE TELESCOPE
    - This telescope will replace which other famous, but aging space telescope? HUBBLE

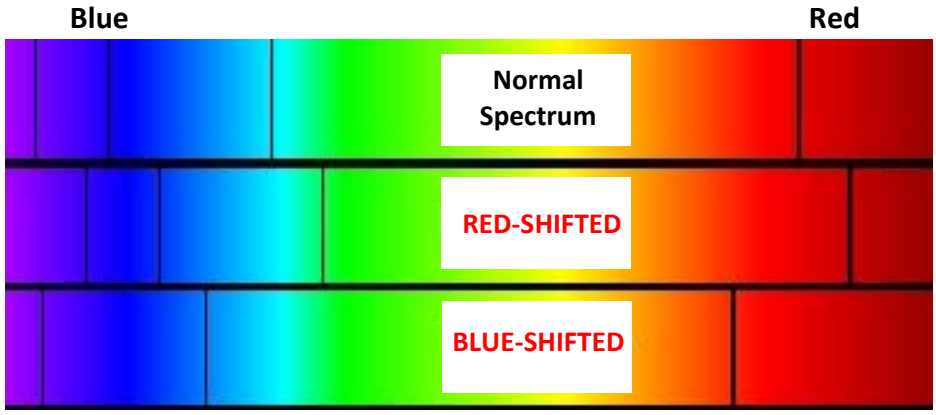
Unit 2 – Universe, Galaxies and Solar System

- **The Universe**
  - What **theory** aims to explain the origins of the universe? BIG BANG
  - What is happening to the universe? IT'S EXPANDING
    - How did Edwin Hubble determine this? What did he notice about the light coming from nearby galaxies? RED - shift
    - On the diagram below, label which spectrum is **red-shifted** and which is **blue-shifted**.
    - Indicate which star below is moving **towards** us and which is moving **away** from us.

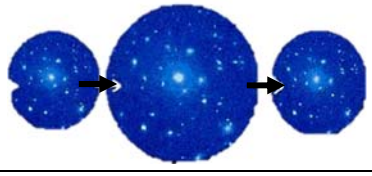
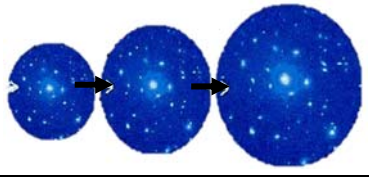
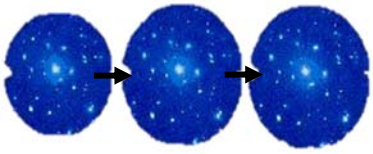
Stationary Star

Star Moving AWAY FROM US

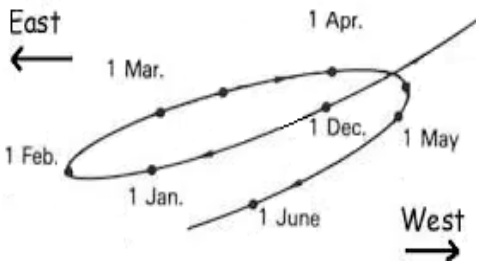
Star Moving TOWARDS US



  - Be familiar with the END of UNIVERSE Theories. Based on the images provided, complete the missing sections of the chart below:

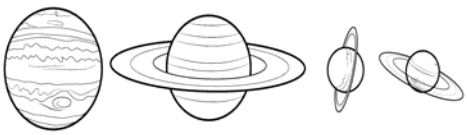
Theory Name→	CLOSED	OPEN	FLAT
Description of what might happen:	• UNIVERSE KEEPS EXPANDING FOR A WHILE, BUT EVENTUALLY STOPS. • GRAVITY THEN BEGINS TO PULL EVERYTHING BACK TO ITS POINT OF ORIGIN. • BIG CRUNCH!	• UNIVERSE CONTINUES TO EXPAND AT ITS CURRENT RATE FOREVER. • EVENTUALLY, ALL STARS DIE AND THE UNIVERSE BECOMES COMPLETELY DARK AND DEAD.	• UNIVERSE CONTINUES TO EXPAND, BUT PROGRESSIVELY MORE SLOWLY OVER TIME. • EVENTUALLY MOLECULAR MOTION COMES TO A COMPLETE STOP (ABSOLUTE ZERO) – BIG FREEZE!
What this looks like:			

- **Galaxies**
  - What is a galaxy? GRAVITATIONALLY-BOUND GROUPING OF MILLIONS-BILLIONS OF STARS, GASES & DUST.
    - What are the three possible shapes of galaxies? SPIRAL, ELLIPTICAL, IRREGULAR
    - What shape is our Milky Way Galaxy? SPIRAL
    - What exists at the center of most galaxies? SUPER-MASSIVE BLACK HOLE
- **Solar System**
  - Know the **two** competing models of the solar system, and which one is correct.
    - **Heliocentric:** (CORRECT) MODEL OF THE SOLAR SYSTEM THAT PLACES THE SUN AT THE CENTER
    - **Geocentric:** (INCORRECT) MODEL OF THE SOLAR SYSTEM THAT PLACES EARTH AT THE CENTER
      - Be familiar with **apparent retrograde motion (ARM)** of Mars and how both models tried to explain it.
        - **What is ARM?** Orbiting objects appear to move BACKWARDS IN ORBIT.



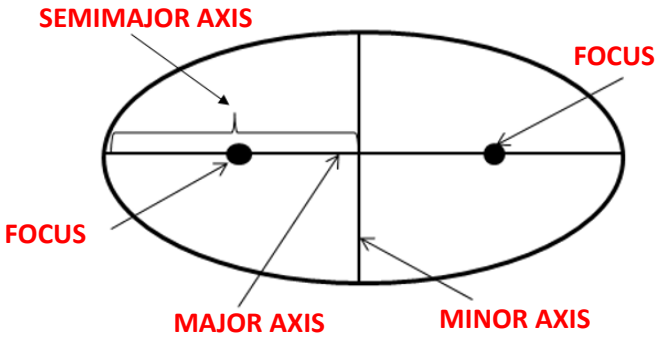
- Geocentric model added EPICYCLES (smaller orbits within bigger orbits) to explain Mars' weird movements.
- Heliocentric model explained that Earth orbits FASTER than Mars because it is CLOSER to the sun. When Earth passes Mars, it looks like Mars is moving backwards in the sky.

  - Know the names and basic characteristics of the planets in the solar system:

		
Names	MERCURY VENUS EARTH MARS	JUPITER SATURN URANUS NEPTUNE
General Characteristics	FEW OR NO MOONS NONE HAVE RINGS MADE UP OF ROCK WITH METAL CORES SMALL IS SIZE	ALL HAVE MANY MOONS ALL HAVE RINGS MADE UP OF GASES LARGE IN SIZE

- What type of object is Pluto? DWARF PLANET
  - Why is it not considered a true planet? IT HASN'T CLEARED ITS ORBITAL NEIGHBORHOOD OF DEBRIS

- **Kepler's Laws of Planetary Motion**
  - **First Law:** PLANETS ORBIT THE SUN IN ELLIPTICAL ORBITS; SUN IS AT ONE OF THE TWO FOCAL POINTS
    - Label the parts of an ellipse:

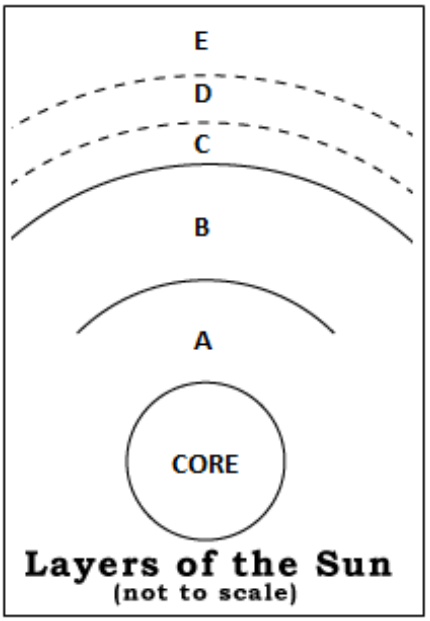


  - **Second Law:** PLANETS "SWEEP OUT" EQUAL AREAS IN ORBIT IN EQUAL TIME DUE TO SPEED CHANGES
  - **Third Law:** THE FARTHER A PLANET IS FROM THE SUN, THE LONGER IT TAKES TO COMPLETE ONE ORBIT
    - Can be represented as the equation: P^2 = A^3
    - Know how to solve 3rd law math problems. Solve for the missing values below:

Average Distance from the Sun (AU)	Orbital Period (years)
3.5 AU	6.55 years
10.08 AU	32 years

Unit 3 – The Sun/Stars and Space Weather

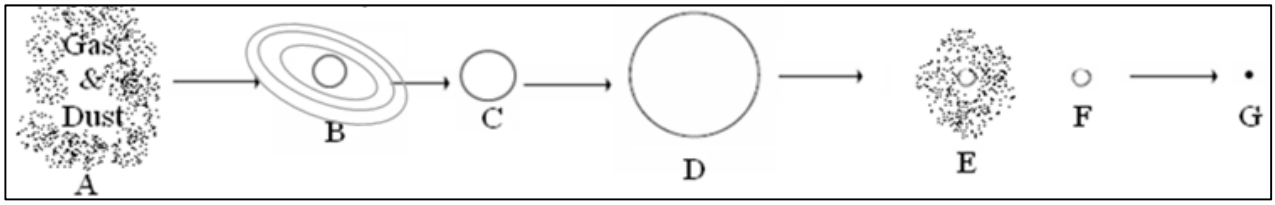
- **Structure of the sun**
  - Know the layers of the sun and basic description of each:
    - Which letter shows the Sun's **Chromosphere**? D
    - Which letter shows the Sun's **Corona**? E
    - Which letter shows the Sun's **Radiation Zone**? A
    - Which letter shows the Sun's **Photosphere**? C
    - Which letter shows the Sun's **Convection Zone**? B
  - How does the sun make energy? HYDROGEN FUSION
    - In which layer does this process take place? CORE



- **Space Weather**
  - What data do we use to track the solar cycle? SUNSPOTS
    - Times of peak sunspot numbers are called: SOLAR MAXIMUMS
    - Times of low sunspot numbers are called: SOLAR MINIMUMS
    - Length of one complete solar cycle is about 10-11 years.
  - Data for what other solar-related occurrence follows a similar cycle? GEOMAGNETIC STORMS
    - In what ways could these storms effect our lives? WIDESPREAD ELECTRICAL BLACKOUTS, DISRUPTION OF SATELLITE-BASED TECH. (GPS)

- **Life Cycles of Stars**

Low to medium mass stars (like the sun):



Name of Stage **Letter on Diagram**

MAIN SEQUENCE Stage of our sun—fusing hydrogen into helium C

BLACK DWARF Cold, **dark** core of a dead star G

RED GIANT Star fuses helium into carbon & expands D

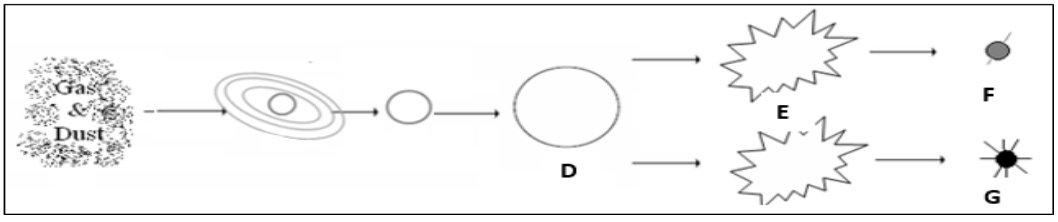
NEBULA Cloud of gas and dust from which a star is born A

WHITE DWARF Small, but hot core of a dying star F

PROTOSTAR Forming star; before nuclear fusion has begun B

PLANETARY NEBULA All fusion has ended and star is losing its outer layers E

High mass stars:



Name of Stage **Letter on Diagram**

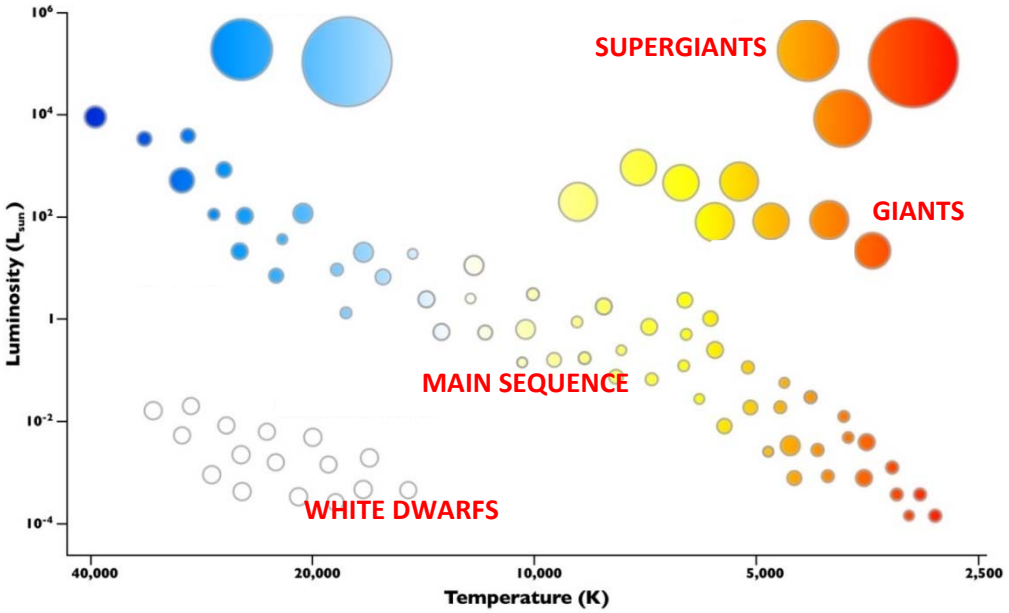
SUPERGIANT Massive star fuses heavier elements & expands D

SUPERNOVA explosion of a massive star E

BLACK HOLE Remnant of **most** massive stars; immense gravitational pull G

NEUTRON STAR Remnant of massive stars; sometimes form jets of light F

- **H-R Diagram**
  - Know the difference between **absolute** and **apparent magnitude.**
  - Be able to read and interpret an H-R diagram.
  - ADD Labels for different groupings of stars below AND Label the approximate location of the Sun:



- Which group of stars is COOLEST and BRIGHTEST? SUPREGIANTS
- Which group of stars is HOTTEST and DIMMEST? WHITE DWARFS
- Which group does our Sun belong to? MAIN SEQUENCE
- Which group of stars is the OLDEST? WHITE DWARFS
- Which group is fusing Hydrogen into helium in their cores? MAIN SEQUENCE
- Which group can **only** fuse helium into carbon? RED GIANTS
- Which group can fuse carbon and beyond? RED SUPERGIANTS

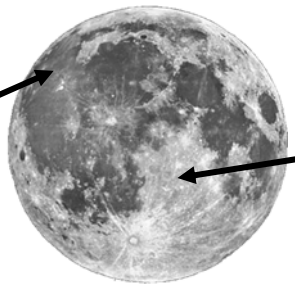
Unit 4: The Moon

- **Theories about how the moon may have formed**
  - Moon formed from a blob of material that broke off Earth: FISSION
  - Earth and the moon formed near each other: CONDENSATION
  - Moon formed from the debris after Earth collided with another object: GIANT IMPACT
  - Earth captured the moon when it drifted too close: CAPTURE
- Which is currently the leading theory for how our moon may have formed? GIANT IMPACT

- **Surface Features of the Moon**

What do we call these darker areas of the moon's surface?

MARIA

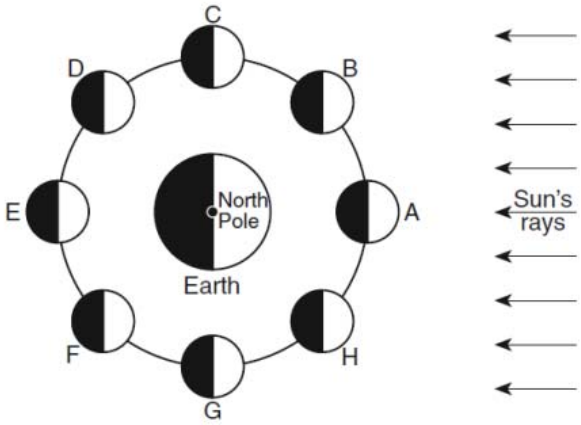


What do we call these lighter areas of the moon's surface?

HIGHLANDS

What we call the powdery lunar soil: **REGOLITH**

- **Phases of the moon**
  - What causes the moon phases? **THE MOON REVOLVING AROUND EARTH BEING ILLUMINATED BY THE SUN**
  - Know the phases. Add the name of the phase at each position indicated and show how it looks.



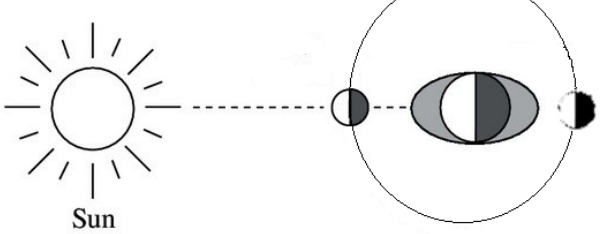
Letter	Name of Phase	Looks Like
A	NEW	
B	WAXING CRESCENT	
C	FIRST QUARTER	
D	WAXING GIBBOUS	
E	FULL	
F	WANING GIBBOUS	
G	THIRD QUARTER	
H	WANING CRESCENT	

- **Moon Phases and Tides**
  - Know that both the Sun and the moon effect the tides, but the moon's effect is **greater**.
  - Know the difference between spring tides and neaps tides and the phases that go with each.

Type of tide shown: SPRING

What phase is the moon in below? NEW

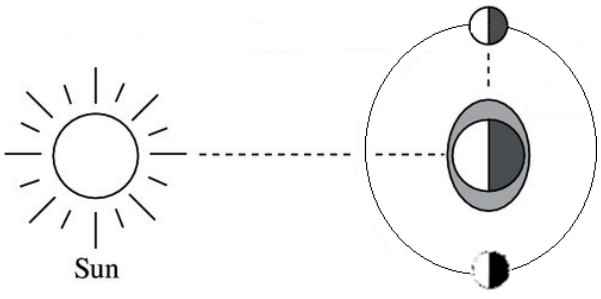
What other phase causes this tide? FULL
Add the moon in this phase to the diagram below:



Type of tide shown: NEAP

What phase is the moon in below? 3RD QUARTER

What other phase causes this tide? 1ST QUARTER
Add the moon in this phase to the diagram below:



Unit 5: History of NASA and Space Exploration

Directions: Please match the NASA program on the right with its description on the left. Each letter is used only **once**!

_____E_____ The goal of this program was to send astronauts to the moon.

_____F_____ This program used monkeys on test flights before Sending humans into space.

_____B_____ America's ***first*** long-term structure in space which served as a science laboratory.

_____A_____ NASA's newest program which will hopefully take humans to Mars one day.

_____D_____ Reusable spacecraft used to **shuttle** astronauts and supplies to and from the International Space Station.

_____C_____ This program resulted in the first **2-man** missions including the first American spacewalk.

_____G_____ This program is still in operation and includes a permanent space structure where astronauts from different countries live and work together in space for months at a time.

A. Artemis

B. Skylab

C. Gemini

D. Space Shuttle

E. Apollo

F. Mercury

G. International Space Station (ISS)

- **Astrobiology**
  - **Earth is located at a perfect distance from the sun that keeps it from getting too hot or too cold.**
    - What do we call this "sweet spot"? _____HABITABLE_____ _____ZONE_____
  - **Scientific theories of how life began on Earth.** Add the name of the theory on the blanks provided:

Theory	Definition
PANSPERMIA	The theory that basic life was *brought* to Earth by comets or asteroids.
ABIOGENESIS	The theory that life began on Earth after many chemical reactions.

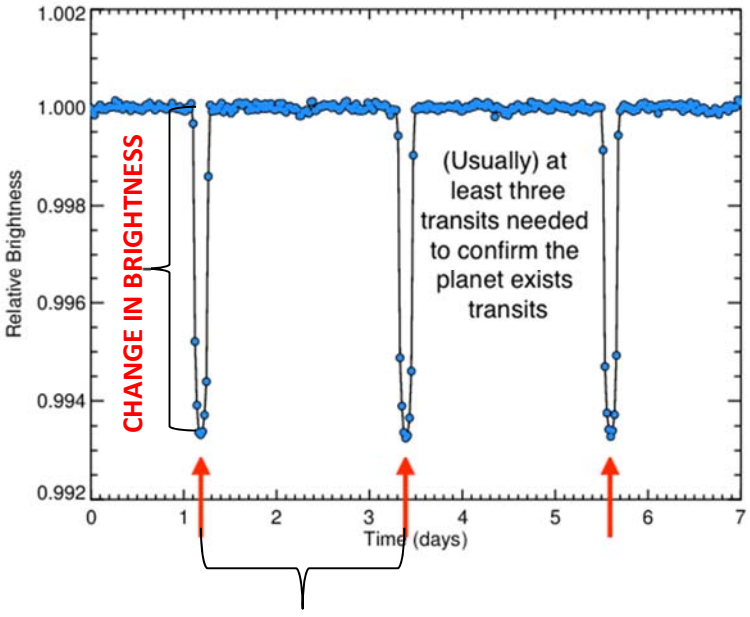
  - **The basic ingredients for life**
    - All life on Earth needs at least 3 key things. Please list them below:
      - LIQUID WATER
      - ENERGY SOURCE (SUNLIGHT, CHEMICALS, TIDAL FLEXING?)
      - CARBON, HYDROGEN, OXYGEN, NITROGEN - CHON

- **Extremophiles.** Complete the boxes below:

	Definition:	Example from class:
Extremophile	**ANY ORGANISM (OFTEN MICROBIAL) THAT THRIVES IN AN EXTREMELY HARSH ENVIRONEMENT**	**TARDIGRADE** (AKA WATER BEAR OR MOSS PIGLET)

  - **Where we might find life beyond Earth?** Provide the names of some places in the **solar system** that we discussed in class may have the 3 ingredients for life:
    - **EUROPA – THICK, ICY SHELL; LIQUID OCEAN BENEATH**
    - **ENCELEDUS – THICK, ICY SHELL; LIQUID OCEAN BENEATH**
    - **TITAN – LAKES OF LIQUID METHANE & ETHANE**

- **Exoplanets and the Kepler Space Telescope (KST)**
  - What is an exoplanet? **A PLANET ORBITING A STAR IN ANOTHER SOLAR SYSTEM**
  - What method is used by Kepler and TESS to find exoplanets? **TRANSIT METHOD**
    - Explain how this method works: **WHEN AN EXOPLANET ORBITS ITS STAR, IT WILL BLOCK A VERY SMALL FRACTION OF ITS STAR'S LIGHT, WHICH WE CAN MEASURE.**
  - Below is an example of a **light curve** graph. Use it to calculate how far this exoplanet is from its star and its size:



ORBITAL PERIOD: 2.2 DAYS

	Exoplanet Characteristics			
Calculate Distance from Sun:	Use Kepler's 3rd Law: $P^2 = A^3$ $P^2 = A^3$ $(.006)^2 = A^3$ $.000036 = A^3$ (CUBE ROOT BOTH SIDES) .03 AU = A (FINAL ANSWER)			**Convert days to years 2.2 / 365 = .006 YR
Calculate Size:	Change in Brightness: 1.00-.993 = .007	Square rooted: $\sqrt{.007}$ = .084	Multiply by 10: .084 x 10 =	Answer: .84 E_R